Angeldust Creator Kit v3.24a

Creating content with Angeldust 4

Creating pictures 4

Take a screen shot 4

Compose beautiful scenes 4

Showcase in-game content 5

Tailor creatures and heroes 6

Creating videos 7

Capture in-game footage 7

Record game replays 7

Play back game replays 8

Make an action movie 8

Creating better media 9

Enhance image quality 9

Improve sprite fidelity 9

Creating maps 10

Export a world map 10

Count used materials 11

Creating 3D-meshes 12

Save a game world 3D-mesh 12

Open 3D-meshes for editing 13

Improve 3D-mesh shading 13

Create realistic skies 14

Texture your 3D-mesh 15

Explore your creativity 16

Using advanced Angeldust features 17

Creating NPCs 17

Add characters 17

Tailor characters 19

Seat characters 20

Let characters talk 21

Show characters on demand 22

Guide characters around 23

Improve character navigation 24

Script character actions 25

Use characters for effects 26
Creating photon machinery 27
Learn photon basics 27
Activate a photon block 28
Launch heroes upwards 29
Reset a photon block 29
Disable a photon injector 30
Steer photons around 31
Split photons 32
Block off photon conduits 33
Repeat photon circuit segments 34
Spawn photon balls 36
Count to ten 37
Conjure creatures and NPCs 38
Animate game world blocks 39
Persist photon machinery 41
Implement hourly triggers 42
Spawn photons remotely 44
Chain remote photon triggers 46
Master advanced photon tricks 47
Imagine endless possibilities 49
Customizing Angeldust 50
Modding game textures 50
Find your texture 50
Determine texture size 51
Set up your color palette 53
Draw your texture 55
Integrate your texture 56
Polish your texture 58
Conform external artwork 59
Speed up texture conversion 60
Learning more 61
Managing local content 61
Find your local content 61
Identify local content 61
References 62

Bundled files 62
Commands 63
Creature ID numbers 64
Photon block sound numbers 73
Revision history 75
Legal 75

Creating content with Angeldust

Creating pictures

Take a screen shot

Available on Windows, macOS and Linux.

Everything you see on screen while playing Angeldust can be saved as a picture called a **screen shot**.

1. Press **P** on the keyboard to take a screen shot while in-game.
2. Angeldust saves a full-quality **PNG image file** to your device.
3. A message pops up:
   ~: **Saved screen shot N**
   ~: **In** ‘Local content folder’
4. The screen shot is now available as **0000000N.png** in your local content folder mentioned under *Find your local content*.

Compose beautiful scenes

Available on all devices.

Use the **Cinematic mode** in Angeldust to hide the user interface and to freely position the camera for better scene composition.

1. While in-game, open the **Options menu** and scroll to the bottom.
2. Set the **Cinematic mode** menu option to **free flight** or **following** to enable camera control.
3. Tweak the **Cinematic time** menu option to make the lighting complement your scene.
4. Close the Options menu to return in-game. You now **control the camera**.
5. Position the camera to your liking and take screen shots **without visual distractions**.
6. Set **Cinematic mode** to **off** when you’re done. You now resume regular play.

Cinematic mode **camera controls** are listed on the Angeldust website under Support.

Showcase in-game content

Available on all devices.

To liven up your screen shots, add **creatures** and **heroes** to your scene.

1. While playing, **move your hero** to where you want to add in-game content. Ensure there are no blocks above you.
2. **Look in the direction** you want the in-game content to face.
3. Open the **Chat log** as if you were going to send a chat message.
4. Send a chat message starting with **/sl** followed by an **ID number** to add a creature or hero at your location.

   Here are a few sample **ID numbers**:

ID number	In-game content	Type	Subtype	Transformed form
1	**Builder**	Hero		Exhausted
2	**Fighter**	Hero		Exhausted
3	**Scout**	Hero		Exhausted
4	**Sorceress**	Hero		Exhausted
8	**Grizzly bear**	Creature	Bear	
47	**Elderling**	Creature	Drakeling	Flying
93	**Bronc**	Creature	Horse	
197	**Day trapper**	Creature	Trapper	Aggressive

5. (Example: **/sl 3** adds a scout hero at your location.)
6. See *Creature ID numbers* under *References* for a **longer list** of creature ID numbers.

Tailor creatures and heroes

Available on all devices.

Customize the appearance of in-game content to perfect the contents and composition of your scene. See *Creating NPCs* for even more ideas.

1. **Follow** *step 1* through *step 3* under *Showcase in-game content* so you are ready to add in-game content at your location.
2. Send a chat message starting with **/sl** followed by:
    1. **ID number** of the creature or hero to add at your location. See the table under *Showcase in-game* content for sample ID numbers.
    2. **Transformed form** to add alternate appearances of creatures and heroes. This must be **0** (default form) or **1** (transformed form) and is optional.

       Not all in-game content can appear in transformed form. See the *Transformed form* table column under *Showcase in-game content*.
    3. **Riding ID number** to make a hero ride a creature. This can only be used when adding heroes and is optional.

       See the table under *Showcase in-game* content for sample ID numbers.
3. (Example: **/sl 47 1** adds a flying elderling at your location.)
4. (Example: **/sl 2 0 93** adds a fighter riding a bronc at your location.)

Creating videos

Capture in-game footage

Available on all devices.

You can record in-game **Angeldust footage** using any video capture application available for your device.

Angeldust is optimized for performance so you can record footage at **high frame rates**.

Angeldust video capture is confirmed to work with **OBS Studio** on Windows and macOS, and **QuickTime Player** on macOS.

Record game replays

Available on all devices.

Preserve your Angeldust adventures for future playback by recording **game replays**. Game replays are tiny files storing game sessions.

1. Before signing in to the game, open the **Options menu** from the **Sign-in form**.
2. Scroll to the bottom of the Options menu and set **Game replays** to **on**.
3. Close the Options menu to return to the **Sign-in form**.
4. Set **Game mode** to **PlayAngeldust.com**. You will see a red recording dot overlaid on the icon.
5. **Every sign-in** to the PlayAngeldust.com game mode records a new game replay.
6. While game replays are being recorded, a **red recording dot** is overlaid on the bottom right corner of the screen.
7. **End recording** game replays by signing out of the game as usual.
8. **Turn off** game replay recording by repeating *step 1* and *step 2*, but set **Game replays** to **off** in *step 2*.

Play back game replays

Available on all devices.

Relive your Angeldust adventures by **playing back** game replays that you recorded.

1. Ensure you have recorded at least one **game replay**, see *Record game replays*.
2. Set the Sign-in form **Game mode** to **Watch replays**.
3. Use the **arrows** on the left side of the screen to **select the game replay** you want to play back. Identify game replays using their recording **date and time**.
4. Start playback with the **Watch replay** button.
5. During game replay playback you can use the **Saddle key or button** to skip ahead.
6. **End playback** by signing out of the game as usual.

Make an action movie

Available on all devices.

Combine game replay playback with **Cinematic mode** to show the action from any angle with beautiful lighting.

1. **Enable video capture**, see *Capture in-game footage*.
2. Start **game replay** playback, see *Play back game replays*.
3. If desired, skip ahead to the part of the action you want to capture using the **Saddle key or button**.
4. Enable **Cinematic mode** to fly around the action and set up lighting, see *Compose beautiful pictures*.
5. Try setting **Cinematic mode** to **following** to see if an orbiting camera motion looks good for your game replay.
6. You can repeat *steps 1 to 5* as many times as you need to capture the **perfect shot**.

Creating better media

Enhance image quality

Available on Windows.

Angeldust PostFX for Windows is a free, official Angeldust add-on that makes your Angeldust pictures and videos prettier by applying post-processing effects.

1. Download Angeldust PostFX for Windows at:
   https://metagaming.itch.io/angeldust
2. Follow the installation and usage instructions in the bundled **README.txt**.
3. Open up the inventory grid or any other in-game menu and press **Home** on your keyboard to tweak Angeldust PostFX for Windows settings.

Improve sprite fidelity

Available on Windows, macOS and Linux.

Angeldust Ultra 2D Sprite Pack is a free, official Angeldust add-on that provides higher quality sprites when using the **ultra** detail level.

1. Open the **Options menu** and ensure you are using **ultra** detail level.
2. Download Angeldust Ultra 2D Sprite Pack at:
   https://metagaming.itch.io/angeldust
3. Follow the installation and usage instructions in the bundled **README.txt**.
4. Angeldust will now use higher quality artwork for sprites in the **old-fashioned**, **cartoon** and **hand-painted** visual style.

Creating maps
Export a world map

Available on Windows, macOS and Linux.

View and share beautiful **world maps** of your creation with your friends. Be a cartographer mapping out the Angeldust game world.

1. **Visit the area** of the Angeldust game world that you want to map.
2. **Explore the area** and regularly open the in-game **World map**.
3. Track the **X- and Y-coordinates** as shown in the **World map** to determine the coordinate range you want to map.
4. **Move away** from the game world area that you want to map. You can use the **Alone** Game mode if desired.
5. Open the **Chat log** as if you were going to send a chat message.
6. Send a chat message starting with **/wm** followed by:
    1. **lower X**-coordinate of the area
    2. **upper X**-coordinate of the area
    3. **lower Y**-coordinate of the area
    4. **upper Y**-coordinate of the area
7. (Example: **/wm 10 16 120 130** maps out the area X 10–16 by Y 120–130.)
8. Angeldust saves a full-quality world map **PNG image file** to your device.
9. A message pops up:
   ~: **--- World map 'screenshot N' ---**
10. The world map is now available as **0000000N.png** in your local content folder mentioned under *Find your local content*.

Count used materials

Available on all devices.

Track which and how many blocks and objects are **used in a land claim**.

1. **Move** to the land claim that you want to investigate. Use the **World map** to ensure you are in the right spot.
2. Open the **Chat log** and send **/cm** as the chat message.
3. Messages pop up tallying **materials used** in the current land claim, showing the **number of occurrences** followed by the **localized name** of each material.
4. A header message pops up listing:
   - X **X-coordinate** of the land claim.
   - Y **Y-coordinate** of the land claim.
   - ∂ Number of **cells different** to the natural game world.
   - Δ Number of **non-empty cells different** to the natural game world.
   - ∑ Number of **non-empty cells**.
5. Use the **Copy to clipboard** button in the Chat log to copy all information to the clipboard for use in another application.
6. Optionally send **//** as a chat message to **clear the Chat log**.

Creating 3D-meshes
Save a game world 3D-mesh

Available on Windows, macOS and Linux.

Create a **high-fidelity 3D-mesh** of areas in the Angeldust game world for use in any 3D-modeling application.

1. Use the **World map** to find the lower and upper **X- and Y-coordinates** of the area you want to save as a 3D-mesh.
2. **Move away** from the game world area that you want to save as a 3D-mesh. You can use the **Alone** Game mode if desired.
3. Open the **Chat log** as if you were going to send a chat message.
4. Send a chat message starting with **/3d** followed by:
    1. **lower X**-coordinate of the area
    2. **upper X**-coordinate of the area
    3. **lower Y**-coordinate of the area
    4. **upper Y**-coordinate of the area
    5. **HH:MM** of the **Cinematic time** used for shading the 3D-mesh
5. (Example: **/3d 10 16 120 130 14:15** saves a 3D-mesh of the area X 10–16 by Y 120–130 shaded at 14:15 in-game time.)
6. Angeldust saves a high-fidelity **Stanford PLY** game world 3D-mesh to your device.
7. A message pops up:
   ~: **--- 3D-mesh '/path/to/3D-mesh.ply' ---**
8. The 3D-mesh is now available as **3D-mesh.ply** in your local content folder mentioned under *Find your local content*.

Open 3D-meshes for editing

Available on all devices.

Import your Angeldust game world 3D-mesh into any 3D-modeling application supporting the **Stanford PLY** format.

3D-meshes are confirmed to work with **Blender v2.7x** on macOS and Linux, and **Blender v2.8x** on Windows and macOS.

1. **Copy** the **3D-mesh.ply** file created in *Save a game world 3D-mesh* to a separate folder on your device. See *Find your local content*.
2. If desired, **rename** the 3D-mesh.ply file.
3. **Import** the 3D-mesh file into your 3D-modeling application using the **Stanford PLY format**.
4. Ensure your 3D-modeling application uses the following orientation for the **3D-axes**:

   X **left** to **right**

   Y **front** to **back**

   Z **bottom** to **top**
5. You can now **view and explore** your Angeldust game world 3D-mesh in your 3D-modeling application.

Improve 3D-mesh shading

Available on all devices.

Set up **geometry** and **material colors** in your 3D-modeling application to improve the fidelity of your renders.

1. **Open** an Angeldust game world 3D-mesh in your 3D-modeling application. See *Open 3D-meshes for editing*.
2. Enable **back-face culling** to prevent shading artifacts in double-sided geometry.
3. Enable **vertex colors** for the 3D-mesh material to apply Angeldust material colors and shading.

Create realistic skies

Available on all devices.

Add a **sky element** to your Angeldust game world 3D-mesh to give it a sense of time and place.

Angeldust exports **environmental lighting colors** in two triangles on the bottom side of your 3D-mesh.

1. **Open** an Angeldust game world 3D-mesh in your 3D-modeling application. See *Open 3D-meshes for editing*.
2. Add a **sky** or **sky dome** to your scene.
3. **Rotate** the view in your 3D-modeling application so that you can see the **bottom side** of the game world 3D-mesh.
4. Use the **color picker** in your 3D-modeling application to set colors for the **sky** created in *step 2*:
    1. **Sun light color** is available in the solidly colored triangle.
    2. **Horizon color** is available along the long edge of the gradient-filled triangle.
    3. **Zenith color** is available in the corner point of the gradient-filled triangle.
5. Alternatively, without a color picker:
    1. **Open 3D-mesh.ply** in a **text editor**.
    2. Skip to the line after **end_header**.
    3. Ensure you see **six lines** that start with either **-2.000000** or **2.000000**.
    4. The lines mentioned in *step 5.3* contain **8-bit RGB color values** in the **4th to 6th** number on each line:
        1. Line one, two and three each contain the **sun light color**.
        2. Line four and five both contain the **horizon color**.
        3. Line six contains the **zenith color**.
    5. Use the **color values** listed in *step 5.4* for the sky element. Divide 8-bit values by **255** for a **0…1** floating point value.

Texture your 3D-mesh

Available on all devices.

Use the **3D-mesh textures** included in Angeldust Creator Kit to add the finishing touch to your game world 3D-mesh.

Angeldust game world 3D-meshes include **material texture coordinates** compatible with Angeldust Creator Kit 3D-mesh textures.

1. Enable **texture (UV) mapping** for your 3D-mesh material.
2. Add an **image texture** to the 3D-mesh material and load one of the **PNG image textures** included in Angeldust Creator Kit:
    1. **Cartoon.png** to emulate the Angeldust **Cartoon** visual style.
    2. **Hand-painted.png** to emulate the Angeldust **Hand-painted** visual style.
3. Set up the image texture from *step 2* to use the **Multiply operator** for both material colors and material alpha.
4. If necessary, also map the image texture from *step 2* to the **material alpha value**. Angeldust Creator Kit 3D-mesh textures support **alpha clipping**.
5. You can try out different **texture sampling** and **texture filtering** modes in your 3D-modeling application to see which one looks best.

Explore your creativity

Available on all devices.

Take your Angeldust game world 3D-meshes to the **next level** by getting creative!

1. **Ambient occlusion** with unshaded, untextured geometry looks very clean.
2. **Isometric projection** works great for creating 3D-world maps.
3. **Depth-of-field effects** can add realism and focus to your scene.
4. **Tilt-shift lens effects** give a miniature world charm.
5. **Only map** an image texture to the mesh material **alpha value** for saturating the mesh colors while retaining contours.
6. **Fly a camera** through your mesh and render it to a movie file.
7. Experiment with **camera Z-axis rotation** to establish camera angles that are impossible to recreate in-game.

Using advanced Angeldust features

Creating NPCs

Add characters

Available on all devices.

Non-player characters, or **NPCs**, add flavor, lore and liveliness for players to explore in your constructions.

1. **Place a photon imitator block** at the location where you want to add an NPC.
2. (Note: NPCs require **at least one empty block above** the photon imitator block.)
3. **Set up** the photon imitator in these steps:
    1. **Select the NPC hero type** using the on-screen arrows, or enter a number directly, confirming with ‘Next’:

NPC hero type number	Hero
1	Builder
2	Fighter
3	Scout
4	Sorceress

    2. **Choose an NPC color** using the on-screen arrows, or enter a color number directly, confirming with ‘Next’:

Color number	Color
1	Blue
2	Violet
3	Red
4	Orange
5	Yellow
6	Green
7	Black
8	White

    3. Optionally, **choose a creature type ridden by the NPC** using the on-screen arrows, confirming with ‘Next’.

4. **Select the NPC starting direction** using the on-screen arrows, or enter a compass direction number directly, confirming with ‘Next’:

Compass direction number	Direction
1	North
2	East
3	South
4	West

5. Optionally, **enter a name** for the NPC and confirm with ‘OK’. In-game NPC names are decorated with **two tilde ~ characters**.
6. (Example: the NPC name ‘Serra’ will show up as **~ Serra ~**.)
7. Your NPC is now **directly added** to the game world if there is enough room for it.
8. If your NPC didn’t show up in *step 7*, make sure there is **enough room** above and to the sides of the photon imitator for the NPC and it’s ridden creature and try again from *step 1*.

Each claimed land in Angeldust can have **up to four active NPCs** in it at a single time. If there are more than four NPCs in a claimed land, only the most **recently added** ones will be visible and active.

Tailor characters

Available on all devices.

Fully customize the colors of your NPCs to create instantly recognizable and memorable characters.

1. **Open the Angeldust website** and sign in using your player name and password.
2. In the top-right website menu box, **choose the hero type** for your new, tailored NPC.
3. (Note: *step 2* is much like customizing the hero colors of **your own heroes**.)
4. Use the website hero color selection boxes to **tailor the hero colors** to your liking.
5. **Write down** the **color code** listed below the right-side hero color preview.
6. (Note: **do not** save the color setup unless you want to update the look of your own hero.)
7. **Start adding an NPC** as described in *Add characters*, and then:
    1. In *step 3 substep 1*: **choose the hero type** you have just tailored on the website.
    2. In *step 3 substep 2*: **enter the color code** you wrote down, **including the # character**.
    3. The **on-screen hero preview** should now **look exactly** like the hero you tailored on the website.
8. **Continue adding the NPC** following the instructions in *Add characters* until you're done.

Seat characters

Available on all devices.

Add NPCs in a sitting pose to mix up their appearance and give a touch of realism to your scenes.

1. **Start adding an NPC** as described in *Add characters*, and then:
    1. In *step 1*: place the photon imitator on top of a **chair**, **column** or **flag block**.
    2. In *step 4*: choose a starting direction that orients the NPC in **a natural way** for the block they will be sitting on.
    3. In *step 7*: your NPC will now be **sitting** instead of standing.

Let characters talk

Available on all devices.

Make NPCs **tell background stories** and **share lore**, deepening the connection players have with your constructions.

1. **Add an NPC** as described in *Add characters* or *Seat characters*.
2. **Place** a **holo scroll block** either:
    1. **Right below** the block the NPC stands or sits on;
    2. Right below the block mentioned in *substep 1* if sitting, so **two blocks below** the block the NPC sits on.
3. While placing the holo scroll, **enter the message** you want the NPC to tell, confirming with ‘OK’.

    You can also:

    1. **Enter multiple message parts** by using the **‘|’ vertical bar** character as a separator between parts.

        NPCs deliver each message part **sequentially**, with a **short delay** in between parts.

        (Example: the message ‘**Hello|Are you OK?**’ will be delivered as ‘Hello’, followed by ‘Are you OK?’.)

    2. **Mention a nearby player’s name** using **[square brackets]** as a text placeholder. With no players nearby, the text between brackets is delivered.

        (Example: the message ‘**Hey [there]!**’ will be delivered as ‘**Hey Magnus!**’ if a player named Magnus is nearby, or as ‘**Hey there!**’ if no player is nearby.)

    3. **Let NPCs deliver quick messages** by using a **# character** followed by **1–8** as a message part.

        (Example: the message ‘**#1**’ will be delivered as ‘**Hello!**’ translated into the language of the receiving player.)
4. The NPC now **talks to nearby players**, sequentially delivering message parts.

Show characters on demand

Available on all devices.

Use the **Angeldust photon system** to create NPCs that **show up on demand** instead of always being around.

1. **Start adding an NPC** as described in *Add characters*, and then:
    1. In *step 5*: **enter a name** for the NPC starting with a **# character**. For example: '#Leenara'.
    2. (Note: the # character **does not show up** in the NPC's name. The NPC from *substep 1* will appear as **~ Leenara ~**.)
    3. In *step 7:* the NPC will **not** immediately show up, as the photon imitator needs to be **triggered by a photon** first.
2. **Build the photon machinery** to trigger the photon imitator, see *Creating photon machinery*.
3. **Include a one-time lock** to prevent triggering the photon imitator multiple times, see *Block off photon conduits*.
4. (Note: **a tiny, one-time lock design** is to have a photon conduit followed by an empty photon block, followed by another photon conduit.)
5. Your NPC now only becomes **visible and active** once the photon imitator is triggered via your photon machinery.
6. (Note: if your NPC **doesn't show up** even when the photon imitator is triggered, **make sure there is enough room** above and to the sides of the photon imitator.)

Guide characters around

Available on all devices.

Place **navigation markers** to **make NPCs walk around** your constructions.

NPCs recognize **two navigation markers**:

1. **Decals** (‘**stickers**’) and **empty photon blocks** right **above ground level**;
2. **Empty photon blocks** right **below ground level**.

Ground level refers to the vertical block level supporting the NPC’s feet **as if standing on a full block**.

Get a feel for ground level by starting with full blocks and then changing out different block heights, observing NPC behavior.

NPCs use navigational markers in a **two-step routine** to walk around. Newly added NPCs start by **scanning for markers** *(A)*:

A. When **scanning for markers**:
    1. Find **empty photon blocks below ground level** to the front, the right and the left, up to eight blocks out.
    2. Find **decals** or **empty photon blocks above ground level** to the front, the right and the left, up to eight blocks out.
    3. If a marker is found in *substep 1* or *substep 2*: **rotate** towards the first found marker and start **walking** *(B)*.

B. When **walking:**
    1. Move forward in the current direction;
    2. When moving onto or above a marker, start **scanning for markers** *(A)*.

Understanding this NPC routine is essential towards efficiently **guiding NPCs around**.

Familiarize yourself with the NPC routine by first making an NPC walk in a straight line, then one turning a corner and finally an NPC going in a square loop.

Improve character navigation

Available on all devices.

Create **elaborate movement paths** for NPCs to make them really come alive. Here are a few tricks to polish NPC movement:

1. Use **inconspicuous decals** like a **water puddle**, **ivy** or the **transparent sticker** to make NPC movement appear seamless in constructions without room for below-ground photon blocks.

2. NPCs find markers **even through walls**, so you can hide decals and photon blocks behind opaque elements.

3. NPCs **ignore decals right next to them** while **sitting**. This lets you decorate tables that NPCs sit at.

4. NPCs **never look for markers behind them**, see *step A* of the NPC routine in *Guide characters around*. Use this directionality to create **asymmetric paths**.

5. NPCs only see **empty** photon blocks as navigation markers.

   You can dynamically adjust NPC paths by **toggling** photon blocks between **empty** and **full**.

   With photon machinery you can make **interactive NPC paths** by letting players toggle photon blocks.

6. Once an NPC is **walking**, it will remain walking forever until it encounters a marker under its feet, as detailed in *step B substep 2* of *Guide characters around*.

   If you '**cloak**' **a marker's visibility** after an NPC has scanned it to rotate and walk towards, the NPC will keep **walking forever** without further guidance.

   You can cloak markers by **placing a block above them**, on top of ground level, compared to where the NPC originally scanned the marker.

   This trick also lets NPCs seamlessly **ascend or descend staircases**.

Script character actions

Available on all devices.

Let NPCs **dance**, **jump**, **attack** and even **activate photon machinery** to polish the NPC interactions in your construction.

1. Familiarize yourself with **ground level** and **navigational markers** as described in *Guide characters around*.
2. In particular, get comfortable guiding NPCs around using **below-ground photon blocks**. Read *Improve character navigation* for tricks to try.
3. Ensure you have an NPC following a path that has room for **below-ground blocks**.
4. **Script NPC actions** by placing one of the following blocks **below ground** under the NPC's walking path:

Block	NPC action	Duration
Conveyor belt (all directions)	Sit down on the next block, visually rotated in the direction of the conveyor belt.	20 seconds
Holo painter	Act out a flourish while changing outfit colors to or from the holo painter's color scheme.	5 seconds
Holo scroll	Deliver a random message part from the holo scroll as a chat message. See *Let characters talk* on message parts.	
Photon counter	Act out a flourish.	5 seconds
Photon faucet	Remove the NPC from the game world.	
Photon injector (★) **Photon remover (◇)**	Act out an interaction while triggering the photon injector (★) or photon remover (◇) as if a player stepped on it, see *Creating photon machinery*.	
Poison barrel	Act out an attack in the current direction.	20 seconds
Trampoline	Perform a jump.	
Treasure	Dance in place.	20 seconds
Wooden frame (horizontal, flat block)	Fall down or stand up, and start or stop crawling. Only NPCs on foot can crawl. (Note: crawling limits the NPC action set.)	5 seconds

5. (Note: NPC actions **only trigger** if an NPC **walks 'over'** the below-ground block.)
6. After a scripted action, NPCs resume their routine in **the direction they faced when starting the action**.
7. (Note: if an NPC ends up **sitting without nearby markers**, the NPC will sit forever.)

Use characters for effects

Available on all devices.

Let NPCs **open up hidden areas** in your constructions and **add persistent creatures** to show off your complete mastery of NPCs.

Here are some **advanced NPC tricks** to try out:

1. Let an NPC trigger a photon injector (★) or photon remover (◇) to **open up doors** or **hidden areas** in your builds. See *Script character actions*.
2. Combine *trick 1* with a **player choice** affecting NPC paths to give a **sense of progression**. See *Improve character navigation*.
3. As NPCs are **fully persistent** and can trigger photon machinery, you can use them to create **permanent effects** like:
    1. Adding **photon imitator creatures** like ravens or owls for **adding atmosphere** to your construction;
    2. **Always-active photon machinery** with **loops** or **counters**;
    3. Persistent, **custom background music** using photon blocks with **musical notes**;
    4. **Strobing or flickering photon block lights** driven by a photon loop;
    5. **Ghost-like** chat messages that seem to have no sender, since you instantly remove the NPC using a **photon faucet**.
4. Make an NPC **dance permanently** with a small navigation loop including a **treasure block**. See *Script character actions*.
5. Create a **persistent NPC sitting anywhere** by making the NPC instantly walk over a **conveyor belt** trigger.

Creating photon machinery
Learn photon basics

Available on all devices.

Photons let you create **dynamic events** and **interactive experiences** in Angeldust. Use the photon system to bring your constructions to life and **delight** visitors.

Photons can be used to create anything from a **switchable light**, via a **photon ball stadium** with live score tracking, to a **fully working in-game processor** (CPU).

1. A **photon** is an energy particle that can **trigger actions** in specific game world blocks.
2. Photons come in **two forms**:
    1. **Star photons (★)** that **activate**, spawned from a **photon injector (★)** block;
    2. **Diamond photons (◇)** that **reset**, spawned from a **photon remover (◇)** block.
3. The following **blocks** can be triggered by photons:

Block	Activated by Star photon (★)	Reset by Diamond photon (◇)
Photon block	Toggles between hollow and solid state.	Reverts to hollow state.
Photon counter	Increases the counter's number by one. Spawns a photon ball when wrapping from nine back to zero.	Reverts the counter's number to zero.
Photon mimic	Toggles between initial, secondary and (optionally) tertiary contents and physical height.	Reverts to initial contents and physical height.
Photon faucet	Spawns a photon ball.	Spawns a photon ball.
Photon imitator	Spawns an imitated creature or NPC opposite the photon.	Spawns an imitated creature or NPC opposite the photon.

4. Angeldust's **starting village** hosts a few small photon machines. Interact with them to **get a basic feel** for the photon system.

Activate a photon block

Available on all devices.

Starting with a **single photon block** you'll develop a better understanding of **how photons interact** with the game world around them.

1. **Ensure** you have a sizable amount of **empty, flat ground** to work with.
2. **Place** a **photon block** on the ground and optionally enter the **musical note or sound** that you want it to play when it is triggered.

   See the table under *Photon block sound numbers* for all sound numbers and descriptions.
3. A photon block can be in **one of two states**:

Photon block state	Appearance	Solidity	Lighting
Hollow	Empty cube with a dotted, white outline.	Hollow—creatures, heroes and other entities can pass through.	Does not give off light.
Solid	Ice cube with a Star photon (★) frozen in the center.	Solid—nothing can pass through.	Gives off light.

4. **Observe** that your newly placed photon block starts out in the **hollow state**.
5. Place a **photon injector (★)** right next to the photon block.
6. **Skip setting up** the photon injector (★)—clear the text entry box and confirm placement with 'OK'.
7. (Note: **all examples** use photon injectors (★) and photon removers (◇) **without setup** unless indicated otherwise.)
8. **Step on and off** the photon injector (★) a few times. Observe that the photon block **toggles** between hollow and solid state with a transition sound each time.
9. Observe that the photon block changes **appearance**, **solidity** and **lighting** as listed in the table under *step 3*.

Launch heroes upwards

Available on all devices.

A photon block changing from hollow to solid **throws heroes into the air**.

Use this property to build **elevators** like the **launchpad** sample machine in the village.

1. **Build the setup** as listed under *Activate a photon block*.
2. **Step onto** the photon injector (★) while still **partly inside** a **hollow photon block**.
3. **Observe** that **your hero flies** a short distance into the air as the photon block turns solid.

Reset a photon block

Available on all devices.

Diamonds (◇) from a **photon remover (◇)** will always **reset** photon blocks to **hollow state**. This makes your machinery **predictable**.

1. **Build the setup** as listed under *Activate a photon block*.
2. **Place** a **photon remover (◇)** right next to the **photon block**.
3. **Step on and off** both the photon injector (★) and photon remover (◇) and **observe interactions** with photon blocks:
    1. **Star photons (★)** change photon blocks from hollow to solid **and vice-versa**;
    2. **Diamond photons (◇)** only change photon blocks from **solid to hollow**.

As listed in the table under *Learn photon basics, step 3* many blocks will behave **differently** when triggered by either a **Star photon (★)** or **Diamond photon (◇)**.

Disable a photon injector

Available on all devices.

You can **block off photon injectors** to prevent players from activating your photon machinery.

1. **Place** a **photon injector (★)** on the ground. **Skip its setup**—just confirm placement with 'OK'.
2. **Place** a **photon block** above the photon injector (★).
3. **Step onto** the photon injector (★).
4. Your hero will fly **into the air** (see *Launch heroes upwards*) and the hollow photon block will **turn solid**.
5. **Observe** that you can now **no longer trigger** the photon injector (★).
6. (Note: you can use this functionality to **block off** one-block **passageways** after letting a single hero through; place a photon injector (★) with a photon block above it right after a doorway.)

Steer photons around

Available on all devices.

Photons can move inside of **photon conduits**, triggering any blocks adjacent to the photon conduit they are traveling through.

Use photon conduits to **trigger machinery**, similar to electrical wiring.

1. **Ensure** you have a sizable amount of **empty, flat ground** to work with.
2. **Place** a **photon injector (★)** on the ground.
3. **Place** a **photon conduit** right next to the photon injector (★).
4. **Connect a** photon conduit to the photon conduit from *step 3*.
5. **Keep connecting** more photon conduits until you are happy with the **photon circuit** that you created.

   (Note: you can connect photon conduits in both the **horizontal** and **vertical** planes as long as they are connected orthogonally.)
6. **Place** one or more **photon blocks** adjacent to the **photon conduits** that make up your photon circuit.

   (Note: try using **different sounds** for each photon block.)
7. **Step onto** the photon injector (★).
8. **Observe** that the **Star photon (★)** travels through **all** the connected photon conduits of your **photon circuit**.
9. **Observe** that all **photon blocks** connected to the photon circuit are **activated** and make **transition sounds** as the **Star photon (★)** travels along.
10. (Note: **Diamond photons (◇)** travel through photon conduits similarly.)

Split photons

Available on all devices.

Photons traveling in a **photon conduit** can **split** to allow **branched** photon machinery.

This enables machines to trigger **multiple independent photon circuits** from a single photon.

(Note: a **land claim** can have **only four active photons** at a time.)

1. **Ensure** you have a sizable amount of **empty, flat ground** to work with and are familiar with **photon conduits** as explained in *Steer photons around*.
2. **Photons** will travel in photon conduits in the direction they are going **until they hit a non-photon conduit** block.
3. When a photon hits a non-photon conduit block in front, the photon will **split** into **all directions** with an **adjacent photon conduit**.
4. To understand *step 3*, place a photon injector (★) along with a photon circuit that contains a **T-junction of photon conduits**.
5. **Step onto** the photon injector (★).
6. **Observe** that the Star photon (★) **splits into two** at the **T-junction**.
7. Photons can split into **two**, **three** or **four**, depending on the number of **adjacent photon conduits** at the point of splitting.
8. (Example: imagine a T-junction that also branches **upwards** and **downwards**.)
9. (Note: a T-junction is **not mandatory**, photons can also split in two orthogonal directions like **left and up**.)
10. (Note: photons **never split backwards**.)
11. (Note: **Diamond photons (◇)** split in photon conduits similarly.)

Block off photon conduits

Available on all devices.

Inline photon blocks can **restrict access** to **photon conduits**. This lets you create **robust** photon machinery that triggers only **when desired**.

1. **Ensure** you have a sizable amount of **empty, flat ground** to work with.
2. **Familiarize yourself** with **photon conduits** as explained in *Steer photons around* and **photon travel** as described in *Split photons*, *step 2*.
3. **Place** a **photon injector (★)** connected to a **straight line** of several photon conduits.
4. **Step onto** the photon injector (★).
5. **Observe** that the Star photon (★) travels along the **entire photon circuit**.
6. **Replace** one photon conduit in the **middle** of the photon circuit with a **photon block**.
7. As an extension to *Split photons*, *step 2*: **Star photons (★)** travel **through hollow** photon blocks in front of them and turn them solid.

   To see this in action:

   1. **Step onto** the photon injector (★) and observe that the **inline, hollow photon block** turns **solid**;
   2. **Step onto** the photon injector (★) once more and observe that the Star photon (★) does **not** travel through the **inline, solid photon block**.

Use **inline photon blocks** to ensure (parts of) your photon machines are activated **only once**.

You can also **dynamically update photon circuits** because **inline**, **solid** photon blocks abide regular travel and splitting rules.

Use **Diamond photons (◇)** to **unblock** photon circuits.

Repeat photon circuit segments

Available on all devices.

Photon conduit loops in a photon circuit let photons **repeatedly trigger** connected blocks.

Use this to build **ongoing** and **repetitive events**.

1. **Ensure** you have a sizable amount of **empty, flat ground** to work with.
2. **Familiarize yourself** with **photon conduits** as explained in *Steer photons around* and **restricting photon conduits** as described in *Block off photon conduits*.
3. **Place** a **four by four square** loop of **photon conduits** on the ground.
4. **Add**, extending from one corner of the square loop, **in series**:
    1. a **photon conduit**;
    2. a **photon block**;
    3. another **photon conduit**;
    4. a **photon injector (★)**.
5. The photon machine as **seen from above** should look like this, rotated or mirrored depending on the orientation you used:

Photon conduit	Photon conduit	Photon conduit	Photon conduit
Photon conduit			Photon conduit
Photon conduit			Photon conduit
Photon conduit	Photon conduit	Photon conduit	Photon conduit

Photon conduit
Photon block
Photon conduit
Photon injector (★)

6. **Ensure** the photon block is **hollow** as it will need to function as a one-time gate, see *Block off photon conduits*.
7. (Note: while constructing photon machinery add a **photon remover (◇)** above or next to your photon block locks to easily reset them to be **hollow**.)

8. **Step onto** the **photon injector (★)**.
9. **Observe** that the newly spawned **Star photon (★)**:
    1. **Travels** through the initial photon circuit segment;
    2. **Activates** the photon block to become **solid** and then;
    3. **Loops repeatedly** around the square photon circuit segment.
10. **Place photon blocks** with different sounds on top of—or next to—the photon conduits that make up the square to create a **looped, musical sequence**.
11. Place **two or more** photon blocks next to a **single photon conduit** to make multiple sounds play simultaneously.
12. (Note: looping photons remain alive until there are **no players nearby** for quite some time, see *Persist photon machinery*.)
13. (Note: photon conduit loops can be **shaped** and **sized any way you want**. The only requirement to keep photons alive is that **a player is nearby**.)

Spawn photon balls

Available on all devices.

Photon balls are **physical Star photons (★)** that players can **interact** with in the Angeldust game world. They spawn from a **photon faucet** or **photon counter**.

Use photon balls to **activate** or **delay** photon machinery and effects based on **player interaction**.

The **photon ball stadium** mentioned in *Learn photon basics* uses a photon ball to let players play a game similar to soccer, tracking score when the photon ball enters a goal.

1. **Place** a **photon injector (★)** and a **photon faucet** right next to it.
2. **Step onto** the photon injector and observe that the photon faucet spawns a **photon ball**.
3. **Interact** with the photon ball and observe that it **bobs** up and down, and **bounces from walls**.
4. **Touch** the photon ball to make it change direction.
5. **Photon balls interact** with other blocks in the game world:

Photon ball touches block	Effect
Conveyor belt (all directions)	Photon ball is magnetized to the conveyor belt and will slide along it.
Photon block (hollow)	Photon block is activated, turning solid and the photon ball jumps up.
Photon injector (★)	Photon ball sinks into the photon injector (★), activating it.
Photon remover (◇)	Photon ball sinks into the photon remover (◇), activating it.
Water	Photon ball bursts without side effects.

6. (Note: photon balls **burst** when getting **too close** to an **older** one so you can't easily spawn multiple photon balls from a single photon faucet.)
7. (Note: photon balls **remain alive** until either a **long time passes** or no players have been nearby for quite some time.)

Count to ten

Available on all devices.

A **photon counter** visually counts from **zero to nine** and then spawns a photon ball, see *Spawn photon balls*.

Use this to **delay** photon machinery, to **space out repetitions** and to **communicate numbers** like a score to players.

1. **Place** a **photon injector (★)** and a **photon counter** right next to it.
2. **Step onto** the photon injector (★).
3. **Observe** that the visible **number** on the photon counter **increases** each time it is activated by the photon injector (★).
4. **Keep stepping** onto the photon injector (★) until the photon counter **wraps back to zero** after displaying nine.
5. **Observe** that the photon counter spawns a photon ball upon wrapping.
6. **Place** a **photon remover (◇)** next to the photon counter.
7. Randomly **step onto** both the photon injector (★) and photon remover (◇) and observe that:
    1. The photon counter value **increases** when activated by a **Star photon (★)**;
    2. The photon counter value **resets to zero** by a **Diamond photon (◇)**.

Conjure creatures and NPCs

Available on all devices.

Photon imitators spawn **imitated creatures** and **NPCs** when activated.

Use photon imitators to create **battle areas** that only unlock after killing creatures, or to populate areas with NPCs when a player triggers **certain conditions**.

For **NPCs**, see *Creating NPCs* and *Show characters on demand*. The following steps apply only to **imitated creatures**.

1. **Place** a **photon injector (★)**.
2. **Place** a **photon conduit** next to the photon injector (★) from *step 1*.
3. **Place** a **photon imitator** on top of the photon conduit from *step 2* and **choose** an **imitated creature** to spawn.
4. (Note: you can only spawn imitated creatures that you have **previously discovered**.)
5. **Step onto** the photon injector (★).
6. **Observe** that a **Star photon (★)** travels through the photon conduit, **activates** the photon imitator which spawns the **imitated creature**.
7. Observe that the imitated creature **glows in yellow and white**.
8. **Attack** the imitated creature to **activate** it.
9. (Note: imitated creatures **are idle** until **damaged by a player**.)
10. **Observe** that the imitated creature **health bar** has a **Diamond icon (◇)** next to it.
11. **Attack** the imitated creature until it is **killed**.
12. (Note: imitated creatures have a **limited repertoire** of **attacks** and **behaviors**.)
13. **Observe** that the imitated creature now spawns a **photon ball** to allow the player to interact with **additional photon machinery**. See *Spawn photon balls*.

Animate game world blocks

Available on all devices.

Photon mimics dynamically **change appearance** and **solidity** by cycling through up to three different block contents.

Use this to create **game world block animations**, **hidden doorways** and **switchable lights**.

1. **Place** a **photon injector (★)**.
2. **Place** a **photon conduit** next to the photon injector (★) from *step 2*.
3. **Place** a **photon mimic** next to the photon conduit from *step 3*.
4. **Set up** the **photon mimic** in these steps:
    1. **Select block contents** for the **initial state** and confirm with 'OK'. Photon mimics always **start out** in their initial state;
    2. (Note: for photon imitator contents you can only select blocks that you have **already unlocked** or **bought**.)
    3. Select block contents for the **secondary state** and confirm with 'OK';
    4. Optionally, select block contents for the **tertiary state** and confirm with 'OK'.
    5. (Note: if you leave the tertiary contents **blank**, the photon mimic will switch between **only two states**.)
5. **Observe** that the photon mimic appears in its **initial state** as chosen in *step 4*, *substep 1*.
6. **Step onto** the photon injector (★) multiple times and **observe** that the photon mimic **cycles** through its **different contents**.
7. (Note: a **Diamond photon (◇)** will **reset** a photon mimic to its **initial state**.)
8. **Step onto** or **through** the **photon mimic** in-between cycling it to **observe** that the photon mimic also **changes physically** between its different states.

    Each of the **three states** gives the photon

mimic a **different solidity** and **physical height** depending on the solidity of the **chosen block contents**:

Solidity of block contents		**Physicality of photon mimic**		
Initial	**Secondary**	**State 1**	**State 2**	**State 3 (optional)**
Fully solid	**Fully solid**	Fully solid	Partially solid	Hollow
Fully solid	**Partially solid**	Fully solid	Partially solid	Hollow
Fully solid	**Hollow**	Fully solid	Hollow	Partially solid
Partially solid	**Fully solid**	Partially solid	Fully solid	Hollow
Partially solid	**Partially solid**	Partially solid	Fully solid	Hollow
Partially solid	**Hollow**	Partially solid	Hollow	Fully solid
Hollow	**Fully solid**	Hollow	Fully solid	Partially solid
Hollow	**Partially solid**	Hollow	Partially solid	Fully solid
Hollow	**Hollow**	Hollow	Fully solid	Partially solid

9. (Note: photon mimics are **not climbable** and **do not inherit functionality** from the block contents they imitate.)

10. (Note: photon mimics **interact differently** with surrounding blocks and other photon mimics. Experiment around to create **unique** block **compositions**.)

Persist photon machinery

Available on all devices.

Photon injectors (★) and **photon removers (◇)** can be **made persistent** so they activate instantly when players come close after a period of inactivity.

Use this to create **always-on** photon machinery that gives a unique **liveliness** to your constructions.

1. Place a **photon injector (★)**.
2. **Set up** the photon injector (★) by entering an **exclamation mark** and confirm with 'OK'.
3. (Note: make sure you only enter a '**!**' character, without quotes.)
4. **Build photon machinery** around the photon injector (★).
5. (Note: for clarity, **include** a **looped photon circuit segment**, see *Repeat photon circuit segments*.)
6. **Step onto** the photon injector (★) as usual and **observe** that your photon machine works and starts **looping**.
7. **Leave** the area of construction and make sure **no players** visit it for quite some time.
8. **Revisit** the area of construction.
9. **Observe** that the photon injector (★) is **automatically activated** and that your photon machinery starts looping again.
10. (Note: **photon removers (◇)** can be made persistent similarly.)

Implement hourly triggers

Available on all devices.

Photon injectors (★) and **photon removers (◇)** can automatically trigger on in-game **hour transitions**.

Use this to **reward players** for visiting at a **specific time**, or to add a **day-night cycle** to your constructions.

Hourly triggers are added by setting up a photon injector (★) or photon remover (◇) by entering an **exclamation mark** followed by the **in-game hour of day** it should trigger.

1. **Get a feel** for in-game time by opening up the **World map**. The **top right** corner displays the **in-game hour of day**.
2. (Note: the Angeldust game world has a **24-hour** day cycle.)
3. **Open** the **World map** and **observe** the current in-game hour, for instance: 13.
4. **Add two to the hour** you observed in *step 3*. For instance, 13 becomes 15.

   If you end up with an hour **larger than 23**, subtract 24 from it, for instance 25 becomes 1.
5. **Place** a **photon injector (★)**.
6. **Set up** the photon injector by entering an **exclamation mark** followed by **the hour** you calculated in *step 4* and confirm with 'OK'.
7. (Example: in our example we would enter '**!15**' without quotes.)
8. (Note: we **added two** to the hour to ensure the photon injector (★) triggers in the **near future** for this example.)
9. **Place** a **photon block** next to the photon injector.
10. **Observe** that the photon block is **hollow**.
11. Open the **World map** again and **wait** until the in-game time enters the hour you calculated in *step 4*.

12. **Observe** that the photon injector (★) is automatically activated **as soon as** the in-game time on the world map transitions into the hour calculated in *step 4*.

13. **Observe** that the photon block has now subsequently turned **solid**.

14. (Note: **photon removers (◇)** can be set up to trigger on in-game hour transitions similarly.)

15. (Note: **each land claim** can only have **one** photon injector (★) or photon remover (◇) set up for **each** of the 24-hour transitions.)

16. (Note: hourly triggers only take place if a **player is nearby** and when the in-game clock **transitions** from one hour to the next. Hourly triggers are **not backlogged**.)

Spawn photons remotely

Available on all devices.

Photon injectors (★) and photon removers (◇) can **spawn up to four photons remotely** instead of spawning a **single photon locally** as used so far.

Use this to **wirelessly trigger** photon machinery and to **avoid photon conduit wiring**.

1. **Ensure** you have a sizable amount of **empty, flat ground** to work with.
2. **Place two photon blocks** away from each other, but within the **same land claim**.
3. (Note: remotely spawned photons **interact with all blocks** that regular photons do and more—see *Chain remote photon triggers*.)
4. **Switch** to the **block picker** item.
5. **Point** the block picker at one of the photon blocks you placed in *step 2*.
6. **Observe** that a set of **local coordinates** is shown at the center bottom of the screen in **yellow**.
7. (Note: if the set of coordinates is **gray instead**, you are not **in the same land claim** as the block you are pointing at.)
8. **Write down** or **remember** the set of local coordinates for the first photon block. For example: '10, 9, 2'.
9. **Point** the block picker at the **other photon block** you placed in *step 2*.
10. **Observe** that a **different set** of local coordinates is now displayed in yellow.
11. **Write down** or **remember** the set of local coordinates for the second photon block. For example: '22, 3, 6'.
12. **Place** a **photon injector (★)** away from the photon blocks from *step 2*, but within the **same land claim**.
13. **Set up** the photon injector (★) by entering **both sets** of **local coordinates** from *step*

8 and *step 11* and confirm with 'OK'. For example: '10, 9, 2, 22, 3, 6' without quotes.

14. (Note: commas between local coordinates **are optional**, so '10 9 2 22 3 6' will work similarly.)

15. (Note: the **most recently displayed** local coordinates are **pre-filled** when placing a photon injector (★) or photon remover (◇) shortly after using the block picker.)

16. (Note: use the **hot bar** or '**Alternate between items**' action to quickly switch items and **pre-fill local coordinates**.)

17. **Step onto** the photon injector (★) a few times.

18. **Observe** that both photon blocks switch from hollow to solid and vice-versa **simultaneously** and without any photon conduits.

19. (Note: you can enter **one to four sets** of **local coordinates** or enter **no local coordinate** for a locally spawned photon in *step 13*.)

20. (Note: **photon injectors (◇)** can spawn remote photons similarly.)

21. (Note: remotely spawned photons **count** towards the **four-photon limit** per land claim.)

When a photon is remotely spawned **inside of a photon conduit**, it **splits** into each connected **photon conduit**. This lets you easily trigger multiple blocks remotely.

Remotely spawned photons can be made **persistent** and **trigger hourly** by **adding** relevant options while setting up a photon injector (★) or photon remover (◇).

See *Persist photon machinery* and *Implement hourly triggers*.

(Example: enter '**13 6 7 !20**' in *step 13* to remotely trigger the block at local coordinate 13, 6, 7 when the in-game time rolls over from hour 19 to 20.)

Chain remote photon triggers

Available on all devices.

In addition to regular interactions, remotely spawned photons can also **trigger photon injectors (★)** and **photon removers (◇)**.

Use this to **chain photon machinery together** and to **automate**, **repeat** and **loop** triggers without photon conduits.

In this example we'll create a photon injector (★) that **instantly reactivates itself** while also toggling a photon block. This is the **tightest loop** possible:

1. **Place** a **photon block** in a land claim.
2. **Place** a **photon injector (★)** away from the photon block from *step 1*, but within the **same land claim**.
3. **Confirm** the photon injector (★) placement with 'OK'—its setup is unimportant for now.
4. **Use** the **block picker** to find and **write down** the **local coordinates** of both the photon block and the photon injector (★). For example: '6, 12, 2' and '8, 9, 3'.
5. **Remove** the **photon injector (★)** from *step 2*.
6. **Place** a **photon injector (★)** again, in the **same spot** from *step 2*.
7. **Set up** the photon injector (★) by entering **both sets of local coordinates** that you wrote down in *step 4*. For example: '6 12 2 8 9 3' (without quotes, commas optional).
8. (Note: by including its **own local coordinates** in its setup, the photon injector (★) will both **reactivate itself** as well as the photon block.)
9. **Step onto** the photon injector (★) **once**.
10. **Observe** that the photon block now **rapidly toggles** between hollow and solid state while the photon injector (★) **continuously reactivates itself**.
11. (Note: **photon removers (◇)** can be chained similarly.)

Master advanced photon tricks

Available on all devices.

Here are some advanced **tips** and **tricks** regarding the photon system in Angeldust:

1. **Photon injectors (★)** and **photon removers (◇)** can not be activated by photons from within a **photon conduit**, but there's a **workaround**:
    1. **Place** a **photon faucet** right **on top** of the photon injector (★) or photon remover (◇);
    2. **Ensure** photons travel through a **photon conduit** adjacent to the photon faucet;
    3. When the **photon faucet** is activated, it spawns a **photon ball**;
    4. The **photon ball** immediately sinks into the photon injector (★) or photon remover (◇) below, **triggering it**.
2. You can **remotely spawn** photons at any local coordinate even if there is **no receiving block present**:
    1. **Star photons (★)** and **Diamond photons (◇)** still spawn and briefly show up at the local coordinate even if no block is present;
    2. **Use** these **transient photons** to create an in-air **light show** or other **visual effect**.
3. **Consider** different solutions for **photon machinery timing**, such as:
    1. A **detour** using **photon conduits**;
    2. A **photon ball** traveling on a **conveyor belt**;
    3. A **photon ball** falling from a large height from a **photon faucet**;
    4. A **photon counter** to **delay** or **space out** repetitions;
    5. An **NPC** walking over photon injectors (★) or photon removers (◇) to trigger photon machinery. See *Script character actions*.

4. Photon injectors (★) and photon removers (◇) can only **remotely spawn** photons **within the same land claim**. Work around this by:

    1. Using regular **photon conduits** for **inter-land claim** photon travel;

    2. Remotely spawning photons in a **small photon conduit** that **crosses** land claim **boundaries**;

    3. Remotely spawning a **photon ball** from a **photon faucet** that drops onto a **conveyor belt** crossing claim boundaries;

    4. **Spawning an NPC** that crosses land claim boundaries, see *Script character actions*.

5. Even though a photon injector (★) or photon remover (◇) only triggers on **a single in-game hour transition**, you can have multiple ones tied to **each of the 24-hour transitions** targeting a **common local coordinate**.

Imagine endless possibilities

Available on all devices.

The photon system in Angeldust can be used to create an **infinite amount** of photon machinery and applications.

Here are some **creative ideas** to kick off your imagination:

1. Create an **elevator** by stacking hollow photon blocks with photon conduits next to them on top of and connected to a photon injector (★). See *Launch heroes upwards*.

   A **photon remover (◇)** at the top of the elevator can reset the photon blocks back to hollow.

2. A **maze** where a player needs to find a photon injector (★) to remotely toggle two photon mimics from solid blocks into an **exit door**.

3. **Automated lighting** by remotely triggering a set of photon blocks or photon mimics to switch between **unlit** and **lit state**.

   Take it further with **hourly triggers** to automatically toggle lighting on and off depending on the time of day. See *Master advanced photon tricks*, *step 5*.

4. A **locked door** that can only be opened with a specific **number combination**, communicated via **photon counters**.

5. **Animated smoke** rising from a chimney by repeatedly toggling several photon mimics in an unpredictable fashion.

6. A **billboard** with letters or symbols made from photon mimics that change color regularly.

7. **Background music** by using photon blocks that are repeatedly triggered from a persistent photon injector (★).

Customizing Angeldust

Modding game textures

Find your texture

Available on Windows, macOS and Linux.

The command-line tool **textureconverter** lets you **modify graphical resources** for use in Angeldust.

1. **Find the texture sheet** PNG image file that contains a texture you want to modify from a subfolder in the '**Modding**' folder:

Texture sheet	Used for	Color format	Matte brightness
alpha.png	Transparent blocks and block overlays.	5551	181
block-decorations.png	Static decorations on block top faces.	5551	222
block-foliage.png	Hedge blocks.	5551	165
decals.png	Decorations, drawings and paintings.	5551	123
flags.png	Flag blocks.	5551	—
foliage.png	Trees and larger vegetation.	5551	231
functional.png	Interactive and animated blocks.	5551	24
holo-symbol.png	Icons floating above interactive blocks.	5551	231
liquid-lava.png	Lava.	5551	—
liquid-lava-void.png	Cyanergy.	5551	—
panels.png	Doors, windows and panel parts.	5551	156
photon-block.png	Photon block contents.	5551	189
reflectors.png	Ice.	RG44	—
regular.png	Opaque blocks.	5551	—
skybox.png	Skybox clouds, ground and horizon.	4444	239
small-foliage.png	Waving decorations on block top faces.	5551	231
smoke.png	Wavy cloud and smoke blocks.	5551	206
symbionts.png	Symbionts.	5551	214
water.png	Water.	RG44	—

2. **Open** the texture sheet PNG image file in a **graphics editor** to inspect it.

3. **Find the texture** that you want to modify within the texture sheet.

Determine texture size

Available on all devices.

To make your artwork fit within the texture sheet, determine the **size and padding** of your texture.

1. Angeldust textures use a resolution of **480 pixels per block** at the **ultra** detail level.
2. Textures have **16 pixels of padding**, edge repetition, on all sides.
3. Block types have **specific texture sizes** to match their physical dimensions:

		Artwork size (pixels)		Padded size (pixels)	
Block type	**Parts**	**Width**	**Height**	**Width**	**Height**
All	All	480	480	512	512
Column, girder	Caps	224	224	256	256
Column, girder	Sides	224	480	256	512
Flag	All	992	480	1.024	512
Panel	Top with middle	480	960	512	992
Stairs	Sides	480	see below, 138	512	—
Thin	Sides	480	see below, 138	512	—
Block decoration	All	720	—	752	—

4. (Note: the **XML texture sheet definitions** included in the 'Modding/Game world texture metadata' list all texture properties like size.)
5. **Stairs and thin block textures** are taken from the **bottom 138 pixels** (2/7th) of the full texture.
6. The **old-fashioned visual style** downscales textures by **a factor of 32**.

   Work with **32 x 32 pixel blocks** to create textures for this visual style:

Block type	Parts	Width (×32)	Height (×32)
All	All	15	15
Column, girder	Caps	7	7
Column, girder	Sides	7	15

Block type	Parts	Width (×32)	Height (×32)
Flag	All	31	15
Panel	Top with middle	15	30
Stairs	Sides	15	~5
Thin	Sides	15	~4
Block decoration	All	~23	—

Set up your color palette

Available on all devices.

Use a **specific texture color palette** to **prevent dithering** of large, single color areas.

1. **Look up the color format** of the texture sheet you're working on under *step 1* of *Find your texture*.

2. **Use only the following values** for each of the **RGB-channels** in your texture:

	5551 color format		4444, RG44 color format	
Value number	**RGB value**	**Hexadecimal**	**RGB value**	**Hexadecimal**
Black, 0	0	00	0	00
1	8	08	17	11
2	16	10	34	22
3	24	18	51	33
4	33	21	68	44
5	41	29	85	55
6	49	31	102	66
7	57	39	119	77
8	66	42	136	88
9	74	4A	153	99
10	82	52	170	AA
11	90	5A	187	BB
12	99	63	204	CC
13	107	6B	221	DD
14	115	73	238	EE
15	123	7B	White, 255	FF
16	132	84		
17	140	8C		
18	148	94		
19	156	9C		
20	165	A5		
21	173	AD		
22	181	B5		

	5551 color format		4444, RG44 color format	
Value number	**RGB value**	**Hexadecimal**	**RGB value**	**Hexadecimal**
23	189	BD		
24	198	C6		
25	206	CE		
26	214	D6		
27	222	DE		
28	231	E7		
29	239	EF		
30	247	F7		
31	White, 255	FF		

3. (Example: the color **123, 123, 123** or **#7B7B7B** is a non-dithered, medium gray for the 5551 color format.)
4. (Example: the color **136, 136, 136** or **#888888** is a non-dithered, medium gray for the 4444 color format.)
5. (Note: the 5551 color format supports a total of **32.768 RGB colors**, the 4444 color format supports **4.096 RGB colors**.)
6. The **RG44 color format** expands the red color channel to RGB luminance and the green color channel to alpha transparency.
7. **4444** and **RG44 color formats** can be interchanged. These formats only specify the **textureconverter** mode of operation and result in the same output format.

Draw your texture

Available on all devices.

Create a new image file in your graphics editor with the dimensions from *Determine texture size*, and **draw your texture** using the color palette from *Set up your color palette*.

1. Make sure you create your texture with the **unpadded artwork size** as listed in *Determine texture size*.

2. (Note: if you design in a **photorealistic texture style**, dithering will not be a problem. You can draw your texture with an **unrestricted color palette**.)

3. If your texture is used for **stairs or thin blocks**, add a horizontal delineator around **138 pixels from the bottom** (342 pixels from the top).

4. **Use mostly grayscale texture designs**. Angeldust multiplies texture colors by an **internal material color**. This affects the on-screen appearance and **perceived contrast** of your texture.

5. Original textures **use colors** to create effects like **gray screw heads** on metal plating.

   Color pick these colors to **copy the effects** to your own textures.

6. (Note: you can **design and use colored textures**, but make sure to test and verify the results for all materials that use the same texture.)

7. In vector-based graphics editors you can use **anti-aliasing**. Edge transitions will look crisp in game.

8. (Note: **panel blocks** are separated into **two texture parts**. A larger texture contains the top and middle portions of a panel, while a smaller texture contains the bottom part.)

Integrate your texture

Available on Windows, macOS and Linux.

Once your texture is finished, **place it onto the original texture sheet** and use **textureconverter** to make it available for use within Angeldust.

1. **Expand the canvas of your texture** from the artwork size to the **padded size** as listed under *Determine texture size*.
2. **Fill the padding** by **repeating the edge pixels** of your texture artwork.
3. **Open** the original **texture sheet PNG image file** and carefully **position your padded texture** over the original texture.
4. (Note: the **XML texture sheet definitions** included in the 'Modding/Game world texture metadata' list all texture properties like position.)
5. **Save** the updated texture sheet image file.
6. In a **shell**, invoke **textureconverter** followed by:
    1. **File name** of the texture sheet PNG image file to convert.
    2. **Color format identifier** as listed under *Find your texture*, like 4444 or 5551.

        (Note: you can use the first character of a color format as shorthand, like '**5**'.)
    3. **Matte brightness** for semi-transparent pixels as listed under *Find your texture*.

        (Note: based on your designs, use a darker or lighter matting brightness to reduce edge artifacts.)
    4. (Optionally: **Forced matting** using '**m**' to make texture contents opaque.)
7. Example **textureconverter** invocations:
    1. **textureconverter alpha.png 5551 181**
    2. **textureconverter regular.png 5 0 m**
    3. **textureconverter.exe water.png r 0**

8. **textureconverter** writes **four .imy files** that you can replace in the appropriate **Angeldust / Textures** subfolder.

9. Once the four .imy files are replaced, **start up** Angeldust and **observe your results**.

Polish your texture

Available on Windows, macOS and Linux.

Textures are **works of art** and can take several iterations to get right. Here are some tips and tricks to **optimize your texture creation workflow**.

1. **Prototype without padding** until you are ready to finalize your design.

   Alternatively, use **solid colors** or **content-aware fills** for padding work-in-progress textures.

2. **Save** your texture sheet PNG image files in **Angeldust / Textures subfolders** so that **textureconverter** converts and replaces **.imy files** directly.

3. Angeldust **hot-reloads textures** when changing the detail level in the options menu.

   After replacing **.imy files**, switch detail levels to instantly see changes. This combines nicely with *step 2*.

4. **Create** a **custom grayscale palette** in your graphics editor. There are only 32 shades of gray in the 5551 color format, and 16 in the 4444 color format.

5. If you want to **collaborate with other designers**, work on and share individual texture files instead of full texture sheets.

6. **Be aware** that the original Angeldust texture designs, graphics files and .imy files are **copyrighted** and **should not be distributed** wholly or in part.

7. **Distribute your texture work** as individual, padded textures so that others can **mix-and-match** them onto their own texture sheets.

Conform external artwork

Available on Windows, macOS and Linux.

Use **textureconverter** to convert a PNG image file to Angeldust's color palette. This lets you create **on-brand in-game artwork**.

1. Invoke **textureconverter** with the **hsv** ('**h**') color format to convert a PNG image to an **hsv.raw** output file.

   A **matte brightness of zero** results in **8-bits** per output color channel. A **non-zero** value results in **5-bits** per output color channel.

2. Example **textureconverter** invocations:

   1. **textureconverter painting.png h 0**

   2. **textureconverter.exe photo.png h 1**

3. Open the **hsv.raw** output file in a graphics editor. Use the original PNG image file dimensions for its size.

   Interpret the data as **8-bit, interleaved RGB color data**.

4. The resulting artwork will use only the six regular color hues of the Angeldust visual design language.

5. If you used **5-bit output** (see *step 1*), the resulting graphics file will integrate into 5551 color format texture sheets **without dithering**.

6. (Note: the in-game Angeldust drawings and paintings were converted using this **textureconverter** mode of operation.)

Speed up texture conversion

Available on Windows, macOS and Linux.

During texture development you might want to work at a lower texture sheet resolution to **speed up textureconverter**.

1. (Note: **.imy files** contain different resolutions of the texture sheet:)

File name	Width	Height	Resolution	Used for
___3.imy	Full	Full	1:1	Ultra detail level.
___2.imy	Half	Half	1:4	High detail level.
___1.imy	Quarter	Quarter	1:16	Normal detail level.
___0.imy	Eighth	Eighth	1:64	Low detail level and mipmap chain.

2. After updating your texture, **save** the resulting texture sheet PNG image file at **50% scale** (1:4 resolution) or **25% scale** (1:16 resolution).
3. **Convert** the resulting PNG image file as usual (*see Integrate your texture*).
4. **Rename .imy files** based on the scale you saved them at.

   For **50% scale** (1:4 resolution):

File name	Action
___2.imy	Rename to **___1.imy**.
___3.imy	Rename to **___2.imy**.

   For **25% scale** (1:16 resolution):

File name	Action
___3.imy	Rename to **___1.imy**.

5. (Note: **distant textures appear black** using this technique.)

Learning more

Managing local content

Find your local content

Available on Windows, macOS and Linux.

Angeldust stores your local content in a single folder, located depending on the **Angeldust version** that you use.

Angeldust version	Local content folder
Windows	Open **%appdata%** in Explorer, then open Metagaming B.V. / Angeldust.
Mac App Store	~/Library/Containers/st.angeldu.AngeldustOSX/Data/Library/Application Support/Metagaming B.V./Angeldust
macOS (other)	~/Library/Application Support/Metagaming B.V./Angeldust
Linux	~/.local/share/Metagaming B.V./Angeldust

The **~** character in *Local content folder* denotes your **home folder**.

Identify local content

Available on Windows, macOS and Linux.

The Angeldust local content folder contains **different types** of files:

File name	Description
0000000N.png	**Screen shot** or **world map**. See *Take a screen shot* and *Export a world map*.
replay000N.adrp	Angeldust **game replay**. See *Record game replays*.
3D-mesh.ply	Game world **3D-mesh**. See *Save a game world 3D-mesh*.
setting_name.txt	Menu option **settings** and **user preferences**.
XXXXXYYYYYZ.chunk	**Game world contents** for the land claim located at the X-, Y- and Z-coordinate.

References
Bundled files
Available on all devices.

Angeldust Creator Kit comes bundled with the following **files**:

Folder	File name	Description
	Angeldust Creator Kit.pdf	The document you are currently reading.
3D-mesh textures	Cartoon.png	Texture sheets representing the **cartoon** and **hand-painted** visual style. For use with Angeldust game world 3D-meshes, see *Texture your 3D-mesh*.
	Hand-painted.png	
Modding / Binaries	textureconverter	Command-line tool to convert **PNG texture sheets** into **.imy files**. See *Modding game textures*.
Modding / Cartoon game world textures	alpha.png …	PNG texture sheets of the **cartoon** visual style for creating **texture mods**. See *Modding game textures*.
Modding / Game world texture metadata	alpha.xml …	**XML definitions** of PNG texture sheet contents. See *Determine texture size* and *Integrate your texture*.

Commands

Availability depends on command.

Angeldust supports the following **commands** entered in the **Chat log**:

Command	Parameters	Description
//		Clear the **Chat log**.
/3d	min**X** max**X** min**Y** max**Y** **HH**:**MM**	Save a game world 3D-mesh for the given **min–max** coordinates, shaded at **HH**:**MM** in-game time (IGT). See *Save a game world 3D-mesh*.
/cm		**Count materials** in the current land claim. See *Count used materials*.
/sl	**ID** [transformed form] [ridingID]	**Spawn local** in-game content with a given **ID number**. Can optionally be spawned in **transformed form** (0 or 1) and **riding** in-game content. See *Showcase in-game content* and *Tailor creatures and heroes*.
/tw	**N**	Telecharge to wonder number **N**. This command works only when playing online and when your telecharger is ready. The Angeldust website 'about' page lists all wonder numbers.
/wm	min**X** max**X** min**Y** max**Y**	Export **world map** for the given **min–max** coordinates. See *Export a world map*.

Creature ID numbers

Available on all devices.

Add **specific in-game content** by looking up creature ID numbers here. Hero ID numbers are included for completeness. See *Showcase in-game content*.

ID number	In-game content	Type	Subtype	Transformed form
1	**Builder**	Hero		Exhausted
2	**Fighter**	Hero		Exhausted
3	**Scout**	Hero		Exhausted
4	**Sorceress**	Hero		Exhausted
5	**Callisto bear**	Creature	Bear	
6	**Brute bear**	Creature	Bear	
7	**Harmonic bear**	Creature	Bear	
8	**Grizzly bear**	Creature	Bear	
9	**Black bear**	Creature	Bear	
10	**Cave bear**	Creature	Bear	
11	**Polar bear**	Creature	Bear	
12	**Rabid bear**	Creature	Bear	
13	**King lion**	Creature	Cat	
14	**Night prowler**	Creature	Cat	
15	**Twilight cat**	Creature	Cat	
16	**Jaguar**	Creature	Cat	
17	**Panther**	Creature	Cat	
18	**Ocelot**	Creature	Cat	
19	**Snow leopard**	Creature	Cat	
20	**Rabid cat**	Creature	Cat	
21	**Thundercat**	Creature	Cat	
22	**24-carat cluster**	Creature	Clusterbunny	
23	**Clusterbunny**	Creature	Clusterbunny	
24	**Dundee crocodile**	Creature	Crocodile	
25	**Irwin alligator**	Creature	Crocodile	
26	**Vital caiman**	Creature	Crocodile	
27	**Plain crocodile**	Creature	Crocodile	

ID number	In-game content	Type	Subtype	Transformed form
28	**Night caiman**	Creature	Crocodile	
29	**Dwarf caiman**	Creature	Crocodile	
30	**Mugger crocodile**	Creature	Crocodile	
31	**Rhombus crocodile**	Creature	Crocodile	
32	**Blue snapper**	Creature	Crocodile	
33	**Shadow alligator**	Creature	Crocodile	
34	**Acid alligator**	Creature	Crocodile	
35	**Kombat Reptile**	Creature	Crocodile	
36	**Shock croc**	Creature	Crocodile	
37	**Knock-out crocodile**	Creature	Crocodile	
38	**Corrosive caiman**	Creature	Crocodile	
39	**Crocobile**	Creature	Crocodile	
40	**Gold bug**	Creature	Crystalbug	
41	**Crystalbug**	Creature	Crystalbug	
42	**Flareling**	Creature	Drakeling	Flying
43	**Impling**	Creature	Drakeling	Flying
44	**Auroring**	Creature	Drakeling	Flying
45	**Drakeling**	Creature	Drakeling	Flying
46	**Huntling**	Creature	Drakeling	Flying
47	**Elderling**	Creature	Drakeling	Flying
48	**Snowling**	Creature	Drakeling	Flying
49	**Fumeling**	Creature	Drakeling	Flying
50	**Swiftling**	Creature	Drakeling	Flying
51	**Swelterling**	Creature	Drakeling	Flying
52	**Darkenling**	Creature	Drakeling	Flying
53	**Sourling**	Creature	Drakeling	Flying
54	**Poisonling**	Creature	Drakeling	Flying
55	**Iceling**	Creature	Drakeling	Flying
56	**Shockling**	Creature	Drakeling	Flying
57	**Stunling**	Creature	Drakeling	Flying
58	**Ravageling**	Creature	Drakeling	Flying
59	**Bileling**	Creature	Drakeling	Flying

ID number	In-game content	Type	Subtype	Transformed form
60	**Goldbunny**	Creature	Dustbunny	
61	**Dustbunny**	Creature	Dustbunny	
62	**Pearlbunny**	Creature	Dustbunny	
63	**Frog prince**	Creature	Frog	
64	**Boom frog**	Creature	Frog	
65	**Gorf frog**	Creature	Frog	
66	**Frog**	Creature	Frog	
67	**Bullfrog**	Creature	Frog	
68	**Poison frog**	Creature	Frog	
69	**Leap frog**	Creature	Frog	
70	**Tropical frog**	Creature	Frog	
71	**Sticky frog**	Creature	Frog	
72	**Acid frog**	Creature	Frog	
73	**Poison dart frog**	Creature	Frog	
74	**Stun frog**	Creature	Frog	
75	**Smolder frog**	Creature	Frog	
76	**Slime frog**	Creature	Frog	
77	**Scorpius**	Creature	Giant scorpion	
78	**King scorpion**	Creature	Giant scorpion	
79	**Queen scorpion**	Creature	Giant scorpion	
80	**Stinger scorpion**	Creature	Giant scorpion	
81	**Crammer scorpion**	Creature	Giant scorpion	
82	**Stapler scorpion**	Creature	Giant scorpion	
83	**Acid scorpion**	Creature	Giant scorpion	
84	**Poison scorpion**	Creature	Giant scorpion	
85	**Sub-Zero Scorpion**	Creature	Giant scorpion	
86	**Shock scorpion**	Creature	Giant scorpion	
87	**Stunner scorpion**	Creature	Giant scorpion	
88	**Kombat Scorpion**	Creature	Giant scorpion	
89	**Jungle scorpion**	Creature	Giant scorpion	
90	**Nihicorn**	Creature	Horse	
91	**Night mare**	Creature	Horse	

ID number	In-game content	Type	Subtype	Transformed form
92	**Earthbound Pegasus**	Creature	Horse	
93	**Bronc**	Creature	Horse	
94	**Thoroughbred**	Creature	Horse	
95	**Tarpan**	Creature	Horse	
96	**High horse**	Creature	Horse	
97	**Elephantastic**	Creature	Mammoth	
98	**Groundbreaker**	Creature	Mammoth	
99	**Woolly Datsit**	Creature	Mammoth	
100	**Mammoth**	Creature	Mammoth	
101	**Colossus**	Creature	Mammoth	
102	**Elder mammoth**	Creature	Mammoth	
103	**Avalancher**	Creature	Mammoth	
104	**Ratite rarity**	Creature	Moa	
105	**Giant Claw**	Creature	Moa	
106	**Moonwalker**	Creature	Moa	
107	**Moa**	Creature	Moa	
108	**Terror bird**	Creature	Moa	
109	**Mountain moa**	Creature	Moa	
110	**Snow moa**	Creature	Moa	
111	**Flu moa**	Creature	Moa	
112	**Thunderbird**	Creature	Moa	
113	**Tropical moa**	Creature	Moa	
114	**Sunshine nimboss**	Creature	Nimboss	Flying
115	**Sunset nimboss**	Creature	Nimboss	Flying
116	**Dawn nimboss**	Creature	Nimboss	Flying
117	**Smog nimboss**	Creature	Nimboss	Flying
118	**Acid rain nimboss**	Creature	Nimboss	Flying
119	**Toxic cloud nimboss**	Creature	Nimboss	Flying
120	**Blizzard nimboss**	Creature	Nimboss	Flying
121	**Thunderstorm nimboss**	Creature	Nimboss	Flying
122	**Slime nimboss**	Creature	Nimboss	Flying

ID number	In-game content	Type	Subtype	Transformed form
123	**Autumn nimboss**	Creature	Nimboss	Flying
124	**Spring nimboss**	Creature	Nimboss	Flying
125	**Lightnimboss**	Creature	Nimboss	Flying
126	**Strix**	Creature	Owl	
127	**Red woodclapper**	Creature	Owl	
128	**Gust owl**	Creature	Owl	
129	**Common owl**	Creature	Owl	
130	**Night owl**	Creature	Owl	
131	**Elder owl**	Creature	Owl	
132	**Snow owl**	Creature	Owl	
133	**Flu owl**	Creature	Owl	
134	**Foxy owl**	Creature	Owl	
135	**Golden Grouse**	Creature	Pheasant	
136	**Phoenix pheasant**	Creature	Pheasant	
137	**Twilight pheasant**	Creature	Pheasant	
138	**Pheasant**	Creature	Pheasant	
139	**Beatlebird**	Creature	Pheasant	
140	**Gray grouse**	Creature	Pheasant	
141	**Snowpicker**	Creature	Pheasant	
142	**Roadrunner**	Creature	Pheasant	
143	**Exotic pheasant**	Creature	Pheasant	
144	**Glorious raven**	Creature	Raven	
145	**Blood raven**	Creature	Raven	
146	**Moonlight raven**	Creature	Raven	
147	**Wood raven**	Creature	Raven	
148	**Raven**	Creature	Raven	
149	**Grave raven**	Creature	Raven	
150	**White raven**	Creature	Raven	
151	**Flu raven**	Creature	Raven	
152	**Amber raven**	Creature	Raven	
153	**Exotic raven**	Creature	Raven	
154	**Endless roamer**	Creature	Roamer	

ID number	In-game content	Type	Subtype	Transformed form
155	**Head roamer**	Creature	Roamer	
156	**Dream roamer**	Creature	Roamer	
157	**Plain roamer**	Creature	Roamer	
158	**Dark roamer**	Creature	Roamer	
159	**Rock roamer**	Creature	Roamer	
160	**Snow scooper**	Creature	Roamer	
161	**Rabid roamer**	Creature	Roamer	
162	**Zone Runner**	Creature	Roamer	
163	**Tropical roamer**	Creature	Roamer	
164	**Sticky roamer**	Creature	Roamer	
165	**Acid roamer**	Creature	Roamer	
166	**Poison roamer**	Creature	Roamer	
167	**Frost roamer**	Creature	Roamer	
168	**Shock roamer**	Creature	Roamer	
169	**Stun roamer**	Creature	Roamer	
170	**Waste roamer**	Creature	Roamer	
171	**Slime roamer**	Creature	Roamer	
172	**King cobra**	Creature	Snake	
173	**Blood cobra**	Creature	Snake	
174	**Nibble snake**	Creature	Snake	
175	**Rattlesnake**	Creature	Snake	
176	**Black mamba**	Creature	Snake	
177	**Garden snake**	Creature	Snake	
178	**Vine snake**	Creature	Snake	
179	**Trump snake**	Creature	Snake	
180	**Boomslang**	Creature	Snake	
181	**Blackadder**	Creature	Snake	
182	**Acid adder**	Creature	Snake	
183	**Spitting cobra**	Creature	Snake	
184	**Boa shockstrictor**	Creature	Snake	
185	**Puff adder**	Creature	Snake	
186	**Death adder**	Creature	Snake	

ID number	In-game content	Type	Subtype	Transformed form
187	**Bushmaster**	Creature	Snake	
188	**Starwatcher**	Creature	Trapper	Aggressive
189	**Sentry trapper**	Creature	Trapper	Aggressive
190	**Vigil trapper**	Creature	Trapper	Aggressive
191	**Trapper**	Creature	Trapper	Aggressive
192	**Night watch trapper**	Creature	Trapper	Aggressive
193	**Turncoat trapper**	Creature	Trapper	Aggressive
194	**Snow trapper**	Creature	Trapper	Aggressive
195	**Poison trapper**	Creature	Trapper	Aggressive
196	**Chase trapper**	Creature	Trapper	Aggressive
197	**Day trapper**	Creature	Trapper	Aggressive
198	**Troika**	Creature	Tripod	Unfolded
199	**Boom pod**	Creature	Tripod	Unfolded
200	**Eye pod**	Creature	Tripod	Unfolded
201	**Tripod**	Creature	Tripod	Unfolded
202	**Pewdiepod**	Creature	Tripod	Unfolded
203	**Elder tripod**	Creature	Tripod	Unfolded
204	**Ice pod**	Creature	Tripod	Unfolded
205	**Rabid tripod**	Creature	Tripod	Unfolded
206	**Sprint pod**	Creature	Tripod	Unfolded
207	**Sky pod**	Creature	Tripod	Unfolded
208	**Rorschach tripod**	Creature	Tripod	Unfolded
209	**Acid tripod**	Creature	Tripod	Unfolded
210	**Poison tripod**	Creature	Tripod	Unfolded
211	**Frost tripod**	Creature	Tripod	Unfolded
212	**Shock tripod**	Creature	Tripod	Unfolded
213	**Stop pod**	Creature	Tripod	Unfolded
214	**Defiler tripod**	Creature	Tripod	Unfolded
215	**Slime tripod**	Creature	Tripod	Unfolded
216	**Troll champion**	Creature	Troll	
217	**Rage troll**	Creature	Troll	
218	**Forest troll**	Creature	Troll	

ID number	In-game content	Type	Subtype	Transformed form
219	**Night troll**	Creature	Troll	
220	**Cave troll**	Creature	Troll	
221	**Yeti**	Creature	Troll	
222	**Nilbog troll**	Creature	Troll	
223	**Blitz troll**	Creature	Troll	
224	**Wonder weedler**	Creature	Weedler	
225	**Red creepler**	Creature	Weedler	
226	**Purple hazer**	Creature	Weedler	
227	**Weedler**	Creature	Weedler	
228	**Overgrower**	Creature	Weedler	
229	**Late bloomer**	Creature	Weedler	
230	**Edelweissler**	Creature	Weedler	
231	**Ivy weedler**	Creature	Weedler	
232	**Weedrunner**	Creature	Weedler	
233	**Exotic weedler**	Creature	Weedler	
234	**Sticky weedler**	Creature	Weedler	
235	**Weed whacker**	Creature	Weedler	
236	**Spray weedler**	Creature	Weedler	
237	**Hoarfrost weedler**	Creature	Weedler	
238	**Shock weedler**	Creature	Weedler	
239	**Rotting weedler**	Creature	Weedler	
240	**Witherer**	Creature	Weedler	
241	**Pollinator**	Creature	Weedler	
242	**Amarok**	Creature	Wolf	
243	**Firefox**	Creature	Wolf	
244	**Breeze wolf**	Creature	Wolf	
245	**Brown wolf**	Creature	Wolf	
246	**Rottweiler**	Creature	Wolf	
247	**Sterling wolf**	Creature	Wolf	
248	**Arctic wolf**	Creature	Wolf	
249	**Rabid wolf**	Creature	Wolf	
250	**Fox wolf**	Creature	Wolf	

ID number	In-game content	Type	Subtype	Transformed form
251	**Juggernaut**	Creature	Woolly rhinoceros	
252	**Basher**	Creature	Woolly rhinoceros	
253	**Lancer**	Creature	Woolly rhinoceros	
254	**Shakermaker**	Creature	Woolly rhinoceros	
255	**Dreddnought**	Creature	Woolly rhinoceros	
256	**Boulderdasher**	Creature	Woolly rhinoceros	
257	**Glacier rhino**	Creature	Woolly rhinoceros	
258	**Rabid rhino**	Creature	Woolly rhinoceros	
259	**Wonderwyrm**	Creature	Wyrm	
260	**Hydra**	Creature	Wyrm	Resurrected
261	**Young wyrm**	Creature	Wyrm	
262	**Acid wyrm**	Creature	Wyrm	
263	**Shadow wyrm**	Creature	Wyrm	
264	**Poison wyrm**	Creature	Wyrm	
265	**Polar wyrm**	Creature	Wyrm	
266	**Clang**	Creature	Wyrm	

Photon block sound numbers

Available on all devices.

Photon blocks can make a variety of sounds when changing states. This table lists **all sounds** and their properties. See *Trigger a photon block*.

Sound number	Musical note	Instrument
1	C0	Kick drum
2	C#0	High tom
3	D0	Snare drum
4	D#0	Rimshot
5	E0	Clash cymbal
6	F0	Cowbell
7	F#0	Suspended cymbal
8	G0	Tambourine
9	G#0	Castanets
10	A0	Woodblock
11	A#0	Washboard
12	B0	Triangle
13	C1	Double bass
14	C#1	Double bass
15	D1	Double bass
16	D#1	Double bass
17	E1	Double bass
18	F1	Double bass
19	F#1	Double bass
20	G1	Double bass
21	G#1	Double bass
22	A1	Double bass
23	A#1	Double bass
24	B1	Double bass
25	C2	Glockenspiel
26	C#2	Glockenspiel
27	D2	Glockenspiel

Sound number	Musical note	Instrument
28	D#2	Glockenspiel
29	E2	Glockenspiel
30	F2	Glockenspiel
31	F#2	Glockenspiel
32	G2	Glockenspiel
33	G#2	Glockenspiel
34	A2	Glockenspiel
35	A#2	Glockenspiel
36	B2	Glockenspiel
37	C3	Glockenspiel
38	C#3	Glockenspiel
39	D3	Glockenspiel
40	D#3	Glockenspiel
41	E3	Glockenspiel
42	F3	Viola
43	F#3	Viola
44	G3	Viola
45	G#3	Viola
46	A3	Viola
47	A#3	Viola
48	B3	Viola

Revision history

Available for general release.

Angeldust Creator Kit saw these **revisions**:

Date	Version	Comments
January 13th, 2023	v3.24a	Expanded *Script character actions* with NPC crawling marker, fixed typos.
October 21st, 2022	v3.22a	Added *Create photon machinery* and *Photon block sound numbers* and added photon references to *Creating NPCs*.
September 2nd, 2022	v3.21f	Improved the 'textureconverter' command-line tool performance and reduced its memory usage, updated 3D-mesh textures.
August 8th, 2022	v3.21e	Corrected the texture sizes for stairs and thin blocks in *Determine texture size* and *Draw your texture*.
August 4th, 2022	v3.21d	Added XML game world texture sheet metadata and updated *Bundled files*, *Determine texture size* and *Integrate your texture*.
July 29th, 2022	v3.21c	Updated *Draw your texture* with additional tips, added *Speed up texture conversion* and implemented support for Mac OS X 10.6 to the 'textureconverter' command-line tool.
July 26th, 2022	v3.21b	Added *Modding game textures* and updated *Bundled files* to document 'Modding' folder contents.
July 7th, 2022	v3.21a	Added /tw to *Commands*.
March 16th, 2022	v3.20a	Updated 3D-mesh textures with new decals, drawings and paintings.
June 18th, 2021	v3.18a	Updated *Improve character navigation* to mention the new, transparent sticker.
March 2nd, 2021	v3.15b	Updated *Let characters talk* with a section on quick messages.
February 23rd, 2021	v3.15a	Added *Creating NPCs* and updated *Take a screen shot*.
August 10th, 2020	v3.12c	Added *Creating better media*, *Bundled files* and *Creature ID numbers*.
August 9th, 2020	v3.12b	Added *Tailor creatures and heroes*, updated related sections.
August 8th, 2020	v3.12a	Initial draft including 3D-mesh textures.

Legal

All rights reserved.

Angeldust Creator Kit
© Frank Lucas, Metagaming B.V.